Topic

INFLUENCE OF SELECTED ANTHROPOMETRIC, PHYSIOLOGICAL AND MOTOR FITNESS VARIABLES ON SWIMMING EFFECIENCY AMONG JUNIOR SWIMMERS

Research proposal submitted to the

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INTRODUCTION:

Wisdom of training procedure including adequate physiological, psychological, nutritional techniques for optimizing athletic performance has increased comprehensively over the current century, and indisputably this new learning has made contribution to the overall changes in human sports performance. Major changes of philosophy have included the much earlier initiation of training and spacious increase in the total volume of requisite preparation (Zeigler, 1977). The modern athletic training was begun during Ancient Greece and early Roman period. With the rise of Greek civilization and its desire to acquire physical excellence through athletics produce the professional specialists of coaching and the advancement of specialists. Professional coaches and trainers also played vital role in life of 'Gladiators' of early Roman empire. Herodicus, a Roman was a doctor as well as coach in the ancient Olympic Games. For many centuries following the decline of Roman period, there was compete shortfall of interest in sports activities. It was not until the commencement of the European Renaissance that sports activities softly acquired a growing popularity (Arnheim & Prentice, 2000). The modern sports training concept as we know it come into the existence during the later period of the 19th century with the firm establishment of National and International games and sports. Swimming is an individual or team sport that requires the use of one's arms and legs to move the body through water. Competitive swimming became popular in the 19th century. The goal of high-level competitive swimming is to break personal or world records while beating competitors in any given event. Swimming in competition should create the least resistance in order to obtain maximum speed. However, some professional swimmers who do not hold a national or world ranking are considered, the best in regard to their technical skills. Typically, an athlete goes through a cycle of training in which the body is overloaded with work in the beginning and middle of the cycle, then the workload is decreased in the final stage as the swimmer approaches competition.

Swimming which was considered to be onlyre a survival activity has now developed into one of the most popular competitive sports at the international and Olympic level. This perhaps one of the few sports where ever increasingly performance is evident now and then and swimmers have attended incredible standards at a relatively much younger age. Where a certain level of physical and mental maturity is necessary before one can understand such sports (Freeman, 1980).

Swimming is an individual or team sport thalht requires the use of one's arms and legs to move the body through water. Competitive swimming became popular in the 19th century. The goal of high-level competitive swimming is to break personal or world records while beating competitors in any given event. Swimming in competition should create the least resistance in order to obtain maximum speed. However, some professional swimmers who do not hold a national or world ranking are considered, the best in regard to their technical skills. With the inclusion of swimming in modern Olympics, competitive swimming came into prominence with events originally only for men but, later events for women were also added. Before the formation of FINA, the competitive swimming had unusual events which were further limited to only four styles of swimming namely, freestyle (crawl stroke), backstroke, breaststroke and butterfly stroke.

Swimmers usually make to and fro movements of arms and legs to propel forward through which, it could be well understood that swimming is much more concerned with Newton's third law of motion i.e. "The Law of Action and Reaction". A swimmer to swim forward, have to pull the water backward with the hands; to maintain a streamlined position in water need to kick down with legs; if a swimmer is swimming along and suddenly wants to stop and stand up, he/she need to pull the hands down changing the body position from horizontal plane to vertical plane so that the legs swing down so that the swimmers land in an upright position. Based on the fact, it can also be determined that swimming requires much energy and power to push the body through the water. Unlike various types of auto racing events, swimming races require swimmers to tap into different physiological 2 systems to enhance their performance. Therefore, swimmers need to undergo vigorous training which has to be planned to utilize scientific logic so that the performance of the swimmers could be maintained and increased gradually.

ANTHROPOMETRIC MEASUREMENTS:

Anthropometric measurements ore dimensions of the structure of the human body taken at specific sites to give measures of length, girth and width. (Mathews, 1978) Height as the distance extending from the lowest point to the highest point of a human being in a natural standing position. (Philips & Hamek, 1979) Weight of the nude human body with empty bowels, is known as body weight. (Kansal, 2008) Chest circumference It is the maximum perimeter of the chest measured at meso-sternal point at the end tidal of normal expiration.

(Kansal, 2008) Shoulder Width Shoulder width is the distance between two acromial processes measured with the help of spreading caliper while the subject sits erect or standing with arms hanging down freely on the sides, with the Frankfort plane. (Kansal, 2008) Arm Span The linear horizontal distance between the dactylion sites (tip of the middle fingers) with the arms extended laterally and at shoulder level. It includes the width of the shoulders and length of both the upper limbs. (Kansal, 2008) Body composition Body composition is the amount of fat mass compared to lean muscle mass, bone and organs, and it is one of the most important morphological features characterizing human organism. Anthropometric measurement consists of objective measurements of structure and functions of the body. The measurement of the structure includes items such as weight, total height and width, the depth and the circumferences of the chest etc. The measurements of functions include such items as pulse rate arterial and venous, blood pressure, muscles strength, basal metabolic rate, estimate from cardiovascular posture and breathing capacity.

PHYSIOLOGY:

The study of human physiology began with Hippocrates in Ancient Greece, around 420 BC, and with Aristotle who applied critical thinking and emphasis on the relationship between structure and function. Human physiology is the study of how the human body functions. This includes the mechanical, physical, bioelectrical, and biochemical functions of humans in good health, from organs to the cells of which they are composed. The human body consists of many interacting systems of organs. These interact to maintain homeostasis, keeping the 6 body in a stable state with safe levels of substances such as sugar and oxygen in the blood (Henry Gray, 2007). Physical activity in children is important as it leads to healthy growth due to physiological benefits. Each system contributes to homeostasis, of itself, other systems, and the entire body. Some combined systems are referred to by joint names. For example, the nervous system and the endocrine system operate together as the neuroendocrine system. The nervous system receives information from the body, and transmits this to the brain via nerve impulses and neurotransmitters. At the same time, the endocrine system releases hormones, such as to help regulate blood pressure and volume. Together, these systems regulate the internal environment of the body, maintaining blood flow, posture, energy supply, temperature, and acid balance (Pedersen & Pedersen, 2012). Physiological variables may be defined as those variables which are directly linked with various physiological systems such as pulse rate, blood pressure, vital capacity, fat percentage, respiratory rate, haemoglobin.

Psychology is a behavioural science, which has made its contribution for improving sports performance. It has helped coaches to coach more effectively and athletes to perform more proficiently. This psychological aspect of sports is gaining much attention among sports administrators. A rapidly growing area of interest in Sports Psychology concerns the use of stress management and other procedures, such as Biofeedback and relaxation technique to athletes for reducing anxiety.

MOTOR FITNESS:

Muscular strength and endurance are both important for swimming. Strength is the amount of force that muscles are able to produce and endurance is the ability of the muscles to perform repeated submaximal contractions over time. In swimming, muscular strength dictates how much amount force swimmer muscles are able to produce to the water, which in turn propels swimmers' body forward. Swimming alone can positively build muscular strength. The water acts as resistance that the muscles have to overcome. Therefore, with consistent swimming, the muscles accept and become stronger. Those who have been swimming compatible for a period of time, however, will discover that because of their muscle acclimatization, the water resistance no longer gives sufficient of a stimulus to challenge their muscles and improve more strength. At that point, those who are looking to develop their swimming performance can incorporate strength-training exercises into their governance to continue to build strength. Explaining in line with the delimitations, objectives and selecting variables and protocol of testing procedures for the purpose of the proposes study, the applies procedure and methodology is explained, which is adopting under the following headings like: selection of the subjects, selection of the variables and their tests, and administration of the tests, and collection of the data and statistical procedures applies for the study, was describes in details.
The following methodology is use to establish "The influence of Anthropometric, Physiological and Motor Fitness Variables on Swolf Efficiency test among Swimmers.

STATEMENT OF THE PROBLEM: The purpose of the present study is to investigate the influence of anthropometric, physiological and motor fitness variables on Efficiency of swimming among junior swimmers.

OBJECTIVES OF THE STUDY:

The objectives of the present study are

1. To assess the performance of swimmers.
2. To test the influence of anthropometric variables on performance of swimmers.
3. To study the effect of physiological variables in relation to the performance of swimmers.
4. To evaluate the motor fitness variables in relation to the performance of swimmers.
5. To identify which anthropometric variables predict the performance of swimmers the most.
6. To identify which physiological variables predict the performance of swimmers.
7. To identify which motor fitness variables predict the performance of swimmers.
8. To examine the relationship between the selected variables in relation to swimming performance.

SIGNIFICANCE OF THE STUDY

The significance of the present study is as follows

1. The findings of the study may assist coaches, trainers, and physical education teachers in identifying the key factors that influence swimming performance in young swimmers.
2. The study's results may provide insights into selecting appropriate programs to assess the performance of swimmers effectively.
3. The study's outcome may aid in determining selected anthropometric, physiological, and motor fitness characteristics for enhancing the performance of swimmers.
4. The findings of the study may be instrumental in understanding which anthropometric variables influence the swimming performance of young swimmers.
5. The study's results may be valuable in identifying which physiological variables have a notable impact on the swimming performance of young swimmers.
6. The study's results may be significant in understanding which motor fitness variables have a critical role in the swimming performance of young swimmers.
7. The study may be useful in identifying potential female swimmers based on their anthropometric, physiological, and motor fitness characteristics for grooming outstanding swimmers.

DELIMITATIONS

The study was confined to the following aspects,

1. The study is delimited to four hundred subjects (N=400). In which 200 subjects will be tested for free style and 200 will be tested for Breast stroke.
2. The subjects are from 4 districts viz. Mysuru, Mandya, Hassan, and Bengaluru.
3. Further the study is delimited to the young swimmers age ranged between 14 to 17 years.
4. The research encompasses two swimming strokes (Free Style, and Breast Stroke).
5. The purpose of the study is confined to two or three years of training experienced swimmers.
6. The subjects represent their respective schools in Inter-School/Club/Association level competitions.
7. The study focuses on selected anthropometric variables such as height, Body weight, and Body composition respectively.
8. The research is delimited to selected physiological variables, such as Oxygen saturation, Breathe holding capacity, and Vital capacity.
9. The study focuses on selected motor fitness variables such as co-ordination, Dynamic flexibility, and leg strength.
10. Swolf efficiency test is selected to assess the swimming performance of the subjects.

LIMITATIONS

The study will be limited in the following factors

1. The subjects come from different social, cultural and economic backgrounds, which will be considered as a limitations for this study.
2. The motivational level of the subjects during testing will not be controlled.
3. The nutritional status and the daily dietary intake of the subjects will not be considered.
4. Factors such as food habits, lifestyle, and climate conditions are beyond the control of the investigator.
5. Only female swimmers are selected for the study.
6. The mood and health status of the subjects during performance are beyond the control of the investigator.

HYPOTHESES

To accomplish the purpose of the study the following hypotheses are formulated.

1. H1: There will be a significant difference between anthropometric measurements and the performance of swimmers.
2. H2: There will be a significant difference between physiological variables and the performance of swimmers.
3. H3: The significant difference between motor fitness variables and the performance of swimmers.
4. H4: The performance of swimmers will differ significantly among all.
5. H5: There may be a significant difference in the anthropometric, physiological and motor fitness variables on Freestyle stroke.
6. H7: It is possible that there will be a significant difference in the anthropometric, physiological, and motor fitness variables on Breaststroke.

DEFINITION OF THE TERMS:

- **SWIMMING:** Swimming is an exercise for people of all ages. It can be easy and inexpensive, and a person can go at their own pace. Swimming helps a person to get or stay in shape, but the benefits also extend to mental health. Water supports the body weight and thus puts no stress on the joints. The activity is pretty exhaustive but it gives upper body a great toning and definition. (Alberts and Others, 2005).

- **ANTHROPOMETRIC MEASUREMENTS:** Anthropometric measurements are dimensions of the structure of the human body taken at specific sites to give measures of length, girth and width. (Mathews, 1978)

    - **Height:** Height as the distance extending from the lowest point to the highest point of a human being in a natural standing position. (Philips & Hamek, 1979)

    - **Body Weight:** Weight of the nude human body with empty bowels, is known as body weight. (Kansal, 2008).

- **Body Composition:** It is the Relative amount of fat, muscles and bone in a person's body. It is often expressed as a percentage of body fat or lean body mass (LBM).

- **PHYSIOLOGY:** The study of human physiology began with Hippocrates in Ancient Greece, around 420 BC, and with Aristotle who applied critical thinking and emphasis on the relationship between structure and function. Human physiology is the study of how the human body functions. (Henry Gray, 2007)

  - **Oxygen saturation:** The percentage of oxygen - carrying haemoglobin in blood compared to the maximum amount it can carry.

    Or

    It is a measure of how much oxygen is circulating in your blood.

  - **Breath Holding:** It is the maximum amount of time a person can hold his breath.
  - **Vital Capacity:** Vital capacity is the maximum amount of air a person can expel from the lungs after a maximum inhalation. It is equal to the inspiratory reserve volume plus the tidal volume plus the expiratory reserve volume (www.definitions.net)

- **MOTOR FITNESS:** A limited phase of motor ability, emphasizing capacity for vigorous work. The aspects selected for emphasis are endurance, power strength, agility, flexibility and balance. (Deepti Shukla 2019)

  - **Coordination:** It is the ability to perform smooth, accurate and controlled movements.

    Or

    Co-ordination is the ability to select the right muscles at the right time with proper intensity to achieve proper action.

- **Dynamic Flexibility:** Dynamic flexibility is the ability to move muscles and joints through their full range of motion during active movement. Extensibility of the soft tissues, ligaments and especially of the muscles and the anatomical structure of the joints help to determine the degree of flexibility. (Deepti Shukla 2019)

- **Leg Strength:** It is the ability of the muscles in legs (including quadriceps, hamstrings, glutes and calves) to exert force and power.

EFFICIENCY OF SWIMMING:

Efficiency in swimming can refer to how well a swimmer uses his energy to perform swimming.

Or

Efficiency in swimming refers to achieving the maximum amount of forward propulsion with the least amount of energy expenditure, encompassing both mechanical and physiological aspects.

SWOLF TEST:

SWOLF is a measure of swimming efficiency. It is a simple and general measure, calculated by adding the time (in seconds) to the stroke count, for a given distance. Essentially the fewer strokes and less time you take, the more efficient you are in the water. As your swimming technique improves you should reduce your score. The name swolf comes from joining the words swimming and golf, as swimmers attempt to lower their score.

Justification for Taking up Sample of 14-17 age group:

While younger age groups (e.g.,10-13 years) are valuable for talent identification, 14-17 year olds allow for a deeper analysis of how physiological and anthropometric traits translate into competitive performance. As difference in biological age can influence results.

The age range of 14-17 years captures late adolescence, a critical period for refining a athletic skills and physiological capacities. During this phase, swimmers undergo significant growth and development in strength, power, endurance, and technique, making it ideal for assessing performance predictors. Swimming in this age bracket typically have 3-5+ years of

structured training, allowing for a more stable assessment of physiological and motor fitness variables (eg., Aerobic capacity, muscular strength and flexibility). At this age range swimmers are likely competing at regional or national levels, providing a performance benchmark for analysis.

Swimmers aged 14-17 years were selected for this study as they represent a critical development stage where anthropometric, physiological and motor fitness attributes are refined. This age range also align with talent identification programs and competitive swimming categories, enhancing the practical applicability of the findings.

Practical relevance:

Coaches and talent identification programs often focus on this age group to predict future potential and optimize training. So this study can inform talent selection, training load management, and individualized coaching approaches. At this age range swimmers may have different coaching, training volumes or competition schedules.

REVIEWS OF RELATED LITERTURE:

According to Good "review locates comparative data useful in the interpretation of the results." John W. Best (1968) remarks that "a familiarity with literature in any problem area helps the student to discover what is already known. What method have been promising or disappointing and what problem remains to be solved, etc." A literature review enables a researcher to accomplish a number of more specific aims. It is likely, for example, that in the early stages of research the researcher may have only a vague idea of the area the researcher would like to explore vastly. The researcher may have only a tentative outline of the research problem. A review of the related literature will help the researcher to focus his tentative problem by both limiting and defining more clearly the topic he is interested in researching. The researcher will be aware of possible pitfalls, or search questions that have been thus far neglected reading around the subject will help the investigator to distil the issues he wishes to concentrate upon and leave him with a concise, detailed and distinct plan of action.

1. **Naskar, Dinabandhu (2022):** He studied about effect of specific training program on selected Motor fitness, anthropometric and physiological parameters of young swimmers. He studied experimental research and the researcher had selected total 28

junior male district level swimmers was taken, in that participants was different stroke and different swimmers, researcher accessed for eligibility to selection the sample for reserved candidates for this all the subject was have three years training experience and different strokes and different swimmers total 13 members. For experimental study researches has taken 15 subject have 2 to 3 years of training experience and only free style sprint swimmers was included for the experiments, purposive sampling methods was taken to selected the subject. The researcher was studied on Motor fitness, Anthropometric and Physiological variables, he study was one group experimental design pre-test, mid-test and post-test was taken from 15 subject. In pre-test he taken the test before sending them to the experimental training after sending the subject to the experiment training of 12 weeks' researcher taken mid-test from the samples, and continued the experimental training up to 24 weeks' post-test was taken. In motor fitness variables all the variables were improved significantly after the specific training period. In anthropometric variables- body height, shoulder width and arms span was founded no significant changes, in body weight after specific training significantly decrease, in chest circumference significant improve after training. In body composition- body mass index and lean body mass there was no significant changes after specific training, percentage of body fat and total body fat was decreased significantly after the training. Physiological Variables there is significant difference in swimmers after the specific training. Because of the training 24 weeks specific training period there is a significant difference was founded from pre-test and post-test, also researcher founded significant difference between experimental group and reserve group.

2. **Abraham Mathews (2021):** the researcher studied on effect of sports specific exercise on selected motor fitness, physiological and performance variables among junior swimmers. The purpose of the study was to determine the effect of swimming specific exercises on motor fitness, physiological and swimming performance. Researcher selected the 30 samples was selected randomly in junior level male swimmers and the subject was delimited with 2 to 3 years swimming training experience on the age group between 15-17 years. In this study researcher was done experimental research to access the significant difference between (two group) experimental group and the control group, experimental group was trained 12 weeks of specific training program and the control group was only regular routine training. And the researcher given 12 weeks of

specific training in dry land and in swimming to improve their specific performances in swimming. The researcher before sending them into the experimental was taken pre-test between controlled group and experimental group after the experimental training session researcher was taken post-test between experimental and control group to find the significand efferent. After the 12 weeks of training researcher tested the motor fitness variables and physiological variables and performance variables among the controlled group and experimental group. For this study researcher used ANCOVA for the significant difference 0.05 level were used to analysis the significant different between controlled and experimental group. finally, researcher found that there was a significant difference between the 2 groups, in motor fitness variables agility, speed flexibility, core strength, shoulder strength, explosive strength and in swimming performance variables in vital capacity there was a significant difference but no significant changes was found in heart rate. In motor fitness founded significant because researcher expressed the experimental group was in 12 weeks specific training so in scientific test founded significant. In heart rate no significant different was found because as per the researcher experimental and controlled group were regularly involved in swimming before the research a there for the both group heart rate has been generated in earlier days so there is no significant difference in heart rate.

3. **S.Thirumalaikumar (2019):** Prediction of Swimming performance based on selected Anthropometric and Somatotyping variables among state level swimmers, in this study researcher was used total 100 state level male swimmers from different swimming pools of Thamilunadu samples selected by the method of random sampling and the age group between 13 to 17 years, in this researcher has used anthropometric and somatotyping variables, in anthropometric- height, weight, circumference, length and skinfold. For this study researched had been used multiple regression method to Analyzed the data and all the cases of confidence was fixed to test the significance at 0.05 level. On this study concluded swimming performances in all the variable was predicted.

4. **Vartika Katiyar (2018):** the purpose of the study was determining swimming ability from anthropometric, psychological and physiological variables, the researcher selected university level players selected universities are Lakshmi Bai national university of physical education, Jiwaji University, Gwalior, Madyapradesh area was selected

randomly 150 subject was selected age group between 17 to 25 years. Researcher selected anthropometric variables arm length, length, height, weight & etc in Physiological variables are Resting heart, blood pressure and vital capacity she studied selected variables and cross checked with data with using the particular statistical test, there was a result was drowning in both anthropometric and physiological variables.

5. **Patrudu, M,S,N (2017)** he studied was compression of health related physical fitness components and physical variable among state level men triathlon athlete, swimmers, cyclist and runners, the purpose of the study was compare the health related physical fitness components and psychological variable among state level triathlon athletes swimmers cyclist and runners, the researcher was selected 120 subject (30 each from the four events)and researcher used health related physical fitness like flexibility, muscular endurance, muscular strength, cardio vascular endurance and body composition . in physiological variables – resting pulse rate, breath holding time, vital capacity and atrial blood pressure. for this study researcher were used to compare the four groups one-way analysis of variance (ANOVA) and F ratio was applied to found significant. And the researcher concluded the result there is a significant different between all four group in health related physical fitness- muscular strength, muscular endurance, flexibility swimmers are better than the other three groups triathlon, cyclist and runners. In psychological variables also researcher was found significant different between four groups triathlon athlete and runners were significantly better than other two group cyclist and runners. Why because significant different was found the nature of four groups was different environment, different practice session, different training method and different participation of the game was causes to significant difference.

METHODOLOGY

Selection of Variables

Anthropometric measurements

Variables	Test/ Tools Administration	Unit of Measurements
Height	Stadiometer	Centimetres (cm)
Body Weight	Digital weighing machine	Kilogram (kg)
Body Composition	Skinfold Calliper	mm

Physiological Variables

Variables	Test/ Tools Administration	Unit of Measurements
Oxygen Saturation	oximeter	% SPO_2
Breath Holding Capacity	Manual nose clip	Seconds
Vital capacity	Spirometer	Litres

MOTOR FITNESS VARIABLES

Variables	Test/ Tools Administration	Unit of Measurements
Coordination	Test with wall and floor markings	Counts / min
Dynamic Flexibility	Wall and floor marking, stopwatch	Counts/min
Leg Strength	Leg Strength Dynamometer	Centimetre

Selection of Subjects:

Four hundred (400) female swimmers those who are meeting inclusion criteria (Free-style, and Breast stroke) sprint swimmers will be considered for the study and they will be selected through purposive sampling method. Subject's age ranges between 14-17 years.

Swimming Efficiency: Swolf test will be used to measure the swimming performance / Efficiency.

STATISTICAL TECHNIQUE:

- To test the hypothesis, discriminate analysis in SPSS statistical package will be used.
- Descriptive statistics used to describe and summarize the study variables, such as mean, median, standard deviation frequency distributions, chart and graphical representation.
- Further the researcher will use step-wise multiple Regression Analysis to develop the prediction equations for assessing the Performance of swimmers. For the computation, multiple regression analysis will be selected on the basis of coefficient of correlations with Performance of swimmers.
- MANOVA is used to analyse the difference between 2 Strokes.

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